SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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TECHNOLOGY DEVELOPMENT UNDER SIMULATED LUNAR ENVIRONMENT FOR LUNAR SURFACE EXPLORATION

Abstract

As a follow on mission of a moon orbiter Kaguya (SELENE), a moon lander SELENE-2 is planed in Japan Aerospace Exploration Agency (JAXA). It lands on the moon surface and performs in-situ scientific observation, environment investigation, and research for future lunar utilization including human activity. At the same time, it demonstrates some key technologies such as precise and safe landing, surface mobility and night survival technologies. To realize the SELENE-2 mission, JAXA Space Exploration Center (JSPEC) makes endeavor to develop advanced technologies that would enable lunar surface activities. In addition, advanced test facilities to simulate lunar environments have been developed for technology verifications. To carry out long-term activities on the lunar surface, the spacecraft and instruments must survive the cold temperatures during the long night. Such as a power supply system and thermal insulation technology that are necessary for long term activity are investigated using a test facility that simulates thermal conditions of the lunar surface. The test facility is a set of vacuum chambers from 0.4 to 1.5m in diameter. Each chamber has a plate that simulates lunar surface temperature. One of the chambers can simulate solar ray by using a Xenon lamp. On the other hand, landing gears are very important subsystem to realize safe landing, and a robotic rover is supposed to play a major role in the SELENE-2 mission scenario. The common to both systems is the interaction with the lunar regolith. The characteristics and property of the lunar regolith is different from the earth sand. Therefore, to verify the performance of the mechanisms that interacts with the lunar regolith, tests on the simulated conditions of the lunar soil is required. Therefore, a test facility consists of a flat plane and a variable inclination slope covered with 30cm of lunar regolith stimulant has been constructed. By using the facility, it is possible to conduct various performance tests of surface exploration systems. In addition, subsurface exploration will be the next step after conducting surface exploration. Drilling techniques will play an important role to achieve future mission goals. A test facility for subsurface exploration was developed to obtain basic data for designing drilling mechanisms and to evaluate their performance in simulated lunar environment on the ground. Drilling tests are being conducted to evaluate auger performance of several drills using simulated lunar soil. This paper describes detail of our technology development and advance test facilities for lunar surface exploration.